

addition of hydrochloric or sulphuric acid diminishes the lævotatory action, and eventually converts it into a marked dextro-rotatory one; addition of acetic acid has a similar, but much less marked effect; with asparagine a point is reached at which the solution, in acetic acid, is optically inactive.

ATTENTION was recently drawn in these "Notes" to an attempt made by Th. Thomsen to show that the numbers expressing the specific rotatory powers of various carbon compounds might be expressed as whole multiples of certain fundamental constants; each of these constants was supposed to be characteristic of a group of allied compounds. Thomsen's methods of calculation have been severely criticised by Landolt (in the *Berichte*), who has shown that from the limited accurate data at our disposal such an attempt as that of Thomsen can only be regarded as a play on numbers, and is devoid of all scientific value.

EXPERIMENTS are described in the May number of the *Journal of the Chemical Society* by Jones and Taylor, which appear to leave little doubt that these chemists have succeeded in preparing a gaseous hydride of boron, and that the probable formula of this compound is BH_3 . The new compound—the existence of which establishes another point of analogy between boron and the nitrogen elements—is prepared by decomposing magnesium boride by a dilute acid; the gas has only been obtained largely mixed with hydrogen; it burns with a green flame, and is decomposed by heat with deposition of boron.

In the course of a paper on the appearance of nitrous acid during the evaporation of water (*Chem. Soc. Journal*), by Warrington, experiments on the detection of this acid, by the use of hydrochloric acid and naphthylamine hydrochloride, are described, which show that one part of nitrous acid is easily detected in 10,000,000 parts of water, and that as small a quantity as one part in 1,000,000,000 can be detected.

In the *Zeitschrift für anal. Chem.* Herr Seelheim describes experiments on the percolation of waters through soils, from which he draws the following general conclusions:—Only that stratum of any soil which is composed of the smallest particles need be considered in determining the permeability by water of the soil of a district. The composition of a soil must be ascertained, otherwise experiments on a large scale furnish no measure of the permeability of that soil. The thickest stratum of sand allows the passage of many hundred times more water than a layer of clay only one centimetre thick. The permeability of dykes may be regulated by inserting layers of clay between layers of sand.

SMALL quantities of carbon monoxide may be detected, e.g. in the air of rooms, by drawing the suspected gas over powdered glass moistened with diluted blood, shaking the blood with a drop of ammonium sulphide and examining by the spectroscope. Strips of paper soaked in a solution of 0.2 gram. palladium chloride in 100 c.c. water serve to detect carbon monoxide: the dried slips are suspended by platinum wires in a large flask with a very little water, and the flask is corked; with five parts of carbon monoxide in the atmosphere of the flask, a black shining deposit of metallic palladium appears on the paper in a few minutes; with one part, in two to four hours; and with 0.5 part, in from twelve to twenty-four hours.

A USEFUL historical account of the investigations made on the subject of dephosphorising pig-iron, appears in *Dingler's polytechnisches Journal*, and in abstract in the May number of the *Journal of the Chemical Society*.

THE rate of chemical reactions having been lately the subject of several investigations and discussions, M. Kayander publishes in the *Russian Journal of the Chemical and Physical Society* (vol. xiii. fascicule 4), the results of his last measurements. Without seeking to establish theories as to a connection between chemical affinity and the rate of reactions, M. Kayander simply tries to make measurements in a branch of chemistry insufficiently worked until now. To simplify the results he has employed a solid body and a liquid one, and has measured the rate of dissolution of magnesium in various acids; the magnesium was taken in the shape of small plates, having a surface of about 2000 square millimetres; the acids, in solutions of 0.01 of the atomic weight (in grammes) in a litre of water. Experiments as to the influence of various degrees of concentration will be published in a second paper. As to the influence of time, he arrives at the conclusion that the reaction begins at the very moment of the immersion of the magnesium in the

acid; acids when mixed produce the same action as if taken separately. As to temperature, its influence is precisely that which it exercises on the diminution of the internal friction of the particles of the liquid against one another, and does not seem to influence the chemical properties of the reacting bodies; the figures M. Kayander has arrived at from a long series of measurements establish that the speed of the reaction is inversely proportional to the internal friction of the medium. The researches will be continued.

PHYSICAL NOTES

ON heating a plate of boracite lately Herr Klein (*Gött. Soc. of Sci.*) was surprised to observe a complete change of the optical image. The boundary lines of the optical fields prove variable with temperature, and often wholly disappear, perhaps reappearing in quite different places. Herr Klein concludes from these and previous observations that boracite does not owe its origin to a twin-like formation of parts of lower symmetry, but is regular, and produces simple individuals; and the optical properties, apparently in sharp contradiction to this, are really due to tensions produced in growth. These divide the crystal into parts of different tension, of which the sometimes stronger suppress the weaker, for certain temperatures and positions of the crystal. (Similar properties in crystals of analcime have been described by Herr Ben Saude to the Göttingen Society.)

AN ingenious, somewhat complex, apparatus, named an *automatic manometer*, or automatic analyser of fire damp, has been recently brought before the Geneva Physical Society by Prof. Monnier (*Arch. des Sci.*, April 15). The fire-damp, in presence of air in excess, is decomposed in a glass vessel by a platinum wire rendered incandescent, and the condensation produced acts directly on a mercury manometer, having platinum wires inserted in its tube. The air of the mine is automatically forced by bellows, every hour and half hour, into the burner. The receiving apparatus stands in the central office. The system includes several electro-magnets, two batteries, pendulums with escapement, an alarm-bell, &c.

THE influence of pressure on the electric conductivity of metal wires has been studied anew by M. Chwolson (*Imp. Acad. of St. Petersburg Bull.*, March); Wartmann's previous experiments, in which wires were compressed between steel plates with caoutchouc lining, having failed to show whether pressure changes the specific resistance. M. Chwolson used a piezometer, giving pressures up to 60 atmospheres, the wire being wound round a glass tube, then passed through it, and the tube inserted in another, which was connected with the piezometer. (The two wire ends were brought out through binding screws.) Among other results, at 3.8 C. the copper wire showed a relative diminution of resistance of about 0.0000013 by one atmosphere of pressure; a hard brass wire about 0.0000011; and a lead wire (at 7° C.) about 0.000011, or ten times more than the brass. Pressing at 17° C. the calorific action preponderates over the direct action of pressure for copper and brass, while the reverse occurs with lead. Moreover, the author proves, in the case of the brass wire, that the pressure causes change of the specific resistance besides change of the resistance through change of the length and thickness. Every relative change of volume involves a relative change of the specific resistance about 3.6 times as great.

M. MASCART showed recently how the phenomenon of Talbot's fringes could be applied to measuring the refractive indices of gases and the difference between the refractive index of a solid and that of a liquid. M. Hurion has further thus measured the difference of the refractive indices of liquids, and in the *Journal de Physique* for April he shows how the refractive index of a liquid may with those fringes be directly determined. The two interferent rays are rendered vertical, so as each to traverse one of the halves of a partitioned rectangular vessel with glass bottom. The liquid being first at the same level in both divisions, its level in one is gradually lowered by a special contrivance, and this has the effect of displacing the fringes in the field of the telescope. Let e be the variation of level, f the number of fringes that have passed a point in the field corresponding to light of wave-length λ , then $e(m-1) = f\lambda$. The letter m represents the refractive index of the liquid for light of wave-length λ . (For further details we refer to M. Hurion's note.)

PROF. TROWBRIDGE lately observed that a steel bar magnetised to saturation at 20° C. and subjected to a temperature of -60° C. lost 66 per cent. of its magnetism (a much greater percentage than that formerly observed by Wiedemann).

PROF. ROBINSON of Ohio concludes from experiments (*Four. Frankl. Inst.*, March) that vibrations in extended media from a remote single centre of disturbance, can only be longitudinal, even in light; that vibrations will be to some extent transversal when due to two or more centres of disturbance not in the same line; and that undulations, to be in a condition called polarised, must consist of vibrations which are transversal, and that no necessity exists for assuming vibrations transversal in front of a polariser. These views are not only contrary to the accepted wave-theory of light, and to the conclusions derived from Maxwell's electromagnetic theory, but appear to be directly negatived by the experiments of Stokes and Fizeau.

IN his third paper on electrical shadows (*Gott. Soc. Nachr.*, February 5) Herr Holtz studies, *inter alia*, the differences in form of the light surface and shadows from the two electricities; the effects of using differently-conducting surfaces under the silk, and of using convex and concave spherical or cylindrical surfaces; the double shadows from two surfaces used as electrodes; the use of a silk screen between pointed electrodes, &c.

A NEW seismometer is described by Dr. G. Wagener of Kioto, Japan, for which he claims several advantages over the ordinary heavy-pendulum seismometers. It consists of a strong rigid frame in the form of a short quadrangular pyramid, from which is suspended an iron ball weighing about fifty pounds by means of a bundle of untwisted silk fibres three feet long. Below this ball is an indicating pendulum consisting of a hollow sphere pivoted near its centre of suspension upon a small polished ball, also rigidly fixed to the frame, and carrying beneath it a light arm, whereby its motions are multiplied twenty-four times. A small sphere fixed to the bottom of the iron ball plays into a cavity in the summit of the indicating pendulum. The latter has, by reason of its construction, a very short period of oscillation as compared with that of the iron ball. Hence when an earthquake occurs the inertia of the heavy ball will keep it for a considerable time in its position, while the pointer of the indicating pendulum moves toward the region whence the disturbance came, and can return almost instantly if the horizontal displacement be succeeded by a displacement in the opposite direction. That the movement of the pendulum may be registered accurately in point of time, a small silk thread attached to the bottom of the indicating pendulum passes through a small eye-hole in a porcelain plate immediately beneath, and thence passes round a light indicating wheel which is also in connection with a lever which at the slightest movement drops, and stops a clock. A kindred apparatus is employed to register the direction of the shock, eight threads from the indicating pendulum of a similar instrument being wound round eight indicating wheels for the eight chief points of the compass. For these instruments it is claimed that there is less error from oscillations than in the usual instruments, the inertia of the indicating pendulum checking the tendency of the weight to swing. A further registering apparatus, consisting of a chronograph drum actuated by a clock which is started by the first shock, is also described. It does not appear that the registering apparatus of Dr. Wagener is in any way an improvement upon the electrical apparatus hitherto employed. Lastly, Dr. Wagener describes an instrument for measuring any possible vertical displacements, a heavy body of considerable inertia being counterpoised while immersed in a tub of water, its movements being magnified by a lever and registered by a thread-wheel arrangement.

M. GAIFFE gives us reason to suppose that part of the disturbance in telephone lines, usually set down to "induction," is due to the conducting-wires being of a magnetisable metal iron, which, when moved in the magnetic field of the earth, experience induction-currents. M. Gaiffe introduced into a telephone-circuit two pieces of steel wire, one magnetised, the other not. On hitting them so as to make them vibrate sharply, sounds were produced in the telephone more strongly by the magnetised strip. The remedy is obviously to employ conducting-wires of some non-magnetic substance, such as copper or manganese bronze.

ACCORDING to P. Tacchini, there are in the sun two regions of spots and faculae at about equal distance (20° and 22°) from the equator, and about the same longitude, which showed con-

tinual activity last year. The fact he considers important for theories as to the sun's physical constitution.

THE last number of the *Journal of the Chemical and Physical Society of St. Petersburg* (vol. xiii., fascicule 4) contains two letters by Prof. A. M. Boutleroff on ice under critical pressure. The former of them was written on February 13, when Prof. Boutleroff had not yet received the number of *NATURE* which contains a detailed description of Prof. Carnelley's experiments; the second on March 17. The experiments which he has made, and which he describes in this second letter, were made, Prof. Boutleroff says, on the same conditions as those of Prof. Carnelley, but the temperature of ice remained at -6° ; a rise of temperature was observed only when a part of the bulb of the thermometer was free from ice, but even in this case it was very slow. "The refrigerating influence of ice was quite manifest, but it was not at any time possible to discover anything showing a rise of temperature." Prof. Boutleroff supposes that Prof. Carnelley has raised the temperature of his thermometer without raising that of ice. "It is true," he says, "that the calorimetric experiment of Prof. Carnelley seems to speak in favour of a heating of the ice itself; but can we not suppose that a kind of covering of hot vapour which was around the ice, remaining on its surface, was transported into the water of the calorimeter, and there neutralised the refrigerating power of the ice?" Prof. Boutleroff proposes also, for the same experiments, to make use of a cryophorus which might be easily appropriated for that use, and which he describes in that case as a cryoscope. When repeating Prof. Carnelley's experiments with a cryoscope, Prof. Boutleroff happened to raise the temperature of the thermometer to $+40^{\circ}$, whilst the bulb of the thermometer was nearly completely covered with ice; but he failed to raise the temperature when he covered the surface of the bulb with a small sheet of platina. He concludes that the bulb of the thermometer in those cases, when it shows a temperature above zero, enters into contact with ice only at some few spots; and the rise of the thermometer might be explained, not only by the thermal translucency of the ice, but also by the circumstance that the vapour disengaged by the melting ice is heated, and reaches the bulb of the thermometer by the small channels formed in the ice; he therefore concludes that Prof. Carnelley's condition as to the ice being in a special state not quite reliable.

GEOGRAPHICAL NOTES

DR. WILD, president of the International Polar Commission, has issued a circular stating that six countries have already intimated their intention to co-operate in carrying out the scheme of simultaneous meteorological, magnetical, and other physical observations in the Arctic regions. These countries, with the proposed stations, are Denmark at Upernivik, Norway in Finmark, Austria-Hungary in Jan Mayen, or perhaps East Greenland, Russia in Novaya Zemlya and at the mouth of the Lena, Sweden in Spitzbergen, and the United States at Point Barrow and in Lady Franklin Bay. Should other countries send in their adhesion to the scheme, this disposition of the stations may be somewhat modified. We are glad to see there is a probability that Germany may establish a station in the Island of South Georgia, and France a station at Cape Horn. An interesting feature in the scheme is that two of the eight proposed Arctic stations are to be equipped at the expense of private individuals, viz., the station in Jan Mayen or in East Greenland at the expense of Count H. von Wilczek of Vienna, and the station in Spitzbergen, as our readers are already aware, by M. L. O. Smith of Stockholm. Is it possible that no public-spirited Englishman will be found to provide the means for England co-operating in this truly international scheme of physical observations in the Polar regions, which play such an important rôle in the meteorology of the globe?

As much has been heard of late respecting the magnificent harbour which the French are likely to make of Lake Bizerta in Tunis, it may be well to correct a misapprehension which has long existed as to its depth. Even in the most recent gazetteers this is said to be fifty fathoms, whereas in a brief but excellent paper which he sent to the Geographical Society many years ago, Admiral Spratt, speaking from his own soundings on the spot, explicitly states that the greatest depth of water in the lake is eight fathoms, with an average of from five to six fathoms. This would no doubt be sufficient for all practical purposes, but at the